

**CLAIMS**

1. A system for monitoring a variable relating to a rotating member, the system comprising:

- 5 - a source of optical energy for emitting optical energy;
- at least one transducer mountable on the member and which transducer in use modulates optical energy received from the source in accordance with changes in the variable; and
- 10 - an optical transmission system mountable between the source and the member for transmitting through free space optical energy between the member and the source.

2. A system as claimed in claim 1 wherein the optical source is mounted at a stationary station and comprises one of a  
15 broadband optical source and a frequency sweeping narrowband source, coupled to a first length of optical fibre.

3. A system as claimed in claim 2 wherein the optical transmission system comprises a first lens and a second lens, the first lens  
20 being mountable on the stationary platform in substantial alignment with the second lens which is mountable on the member.

4. A system as claimed in claim 3 wherein the first lens and the second lens comprise a pair of graded-index lenses.

5. A system as claimed in any one of claims 2 to 4 wherein the transducer comprises a second length of optical fibre and an optical energy modulating arrangement connected to the second length of optical fibre.

6. A system as claimed in claim 5 wherein the modulating arrangement comprises a first optical energy reflective element and a second optical energy reflective element.

7. A system as claimed in claim 6 wherein the first and second elements comprise a first and a second Bragg grating having respective center frequencies which are spaced in wavelength.

8. A system as claimed in claim 6 or claim 7 wherein the first and second elements are mounted on the member in spaced relationship relative to one another.

9. A system as claimed in claim 6 or claim 7 wherein the first and second elements are mounted on the member in at least partially overlapping relationship with one another.

5 10. A system as claimed in claim 8 or claim 9 wherein the first and second elements are mounted on the member at ninety degrees relative to one another.

10 11. A system as claimed in any one of claims 8 to 10 wherein each of the first element and the second element extends at an angle of forty-five degrees to a longitudinal axis of the rotating member.

15 12. A system as claimed in any one of claims 3 to 10 comprising means for separating optical energy emitted by the source and modulated energy propagating from the transducer.

13. A system as claimed in claim 12 wherein said means comprises an optical circulator having a first port connected to the source, a second port connected to the first lens and an output.

14. A system as claimed in claim 13 wherein the output of the circulator is connected to means sensitive to modulation of the optical energy.

5 15. A method of monitoring a variable relating to a rotating member, the method comprising the steps of:

- transmitting optical energy through free space towards the member;
- on the member causing the energy to be modulated in  
10 accordance with the variable to be monitored;
- transmitting from the member and via free space the modulated energy to a stationary station; and
- analyzing said modulated energy at the stationary station.